FULL FIELD X-RAY IMAGING (FXI)

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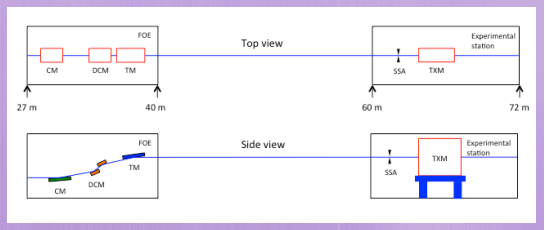
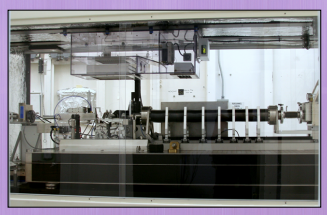
BROOKHAVEN NATIONAL LABORATORY

NATIONAL SYNCHROTRON LIGHT SOURCE II NEXT project • funded by DOE

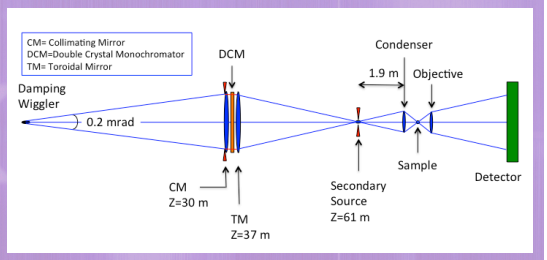
TECHNIQUES AND CAPABILITIES

- Transmission x-ray microscope (TXM)
- Energy range: 5-12 keV
- Spatial resolution: 30 nm
- Field of view: 20-50 μm
- In-situ nanotomography
- Complete 3D data set in < 1 minute
- Nano-XANES capability
- Accepts environmental cells

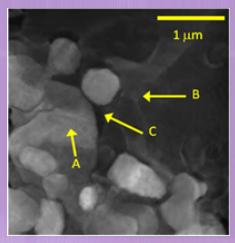




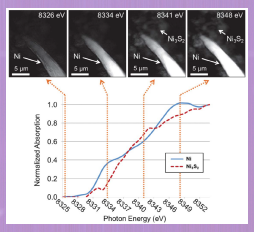
- TXM acquired with ARRA funding
- Manufactured by Xradia
- Currently in operation at NSLS X8-C (APL 100, 143107 (2012))
- FXI will be ~10^2-10^3X faster



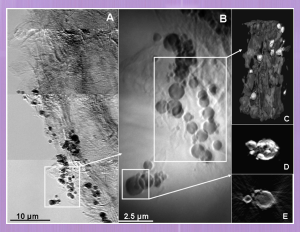
APPLICATIONS



Tomographically reconstructed 3D volumetric data of a Ni-YSZ cermet sample used as solid-oxide fuel cell anode. Enhanced contrast between the Ni and YSZ phases are achieved by tuning the incident x-ray energy just above the Ni K-edge. A: Ni phase (anode), B: YSZ phase (electrolyte), C: porous triple-phase-boundary between the anode and electrolyte. Wilson et. al. J. Electrochemical Society, 157 (6) B783-B792 (2010).

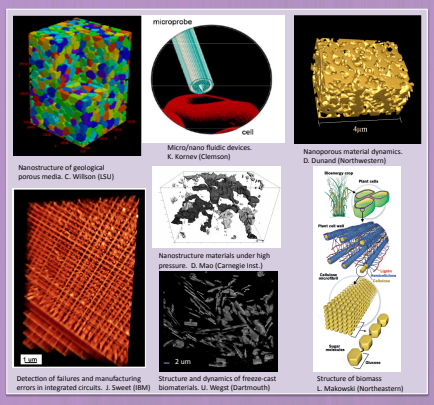


Nano-XANES of a sample with Ni and Ni_3S_2. By performing nano-CT at different energies across the Ni K-edge, the two different chemical states of Ni can be identified. Harris et. al. Nanoscale 4, 1556-1560 (2012). The FXI TXM will be able to perform these types of measurements much faster, enabling 3D time-resolved studies.



TXM studies of Hg binding in the Rhizosphere of Spartina Cordgrass. (A) Mosaic of projection images showing location of Hg in plant root. Using Zernike phase contrast, the high density particles are shown to be outside the root (C). A cut through one particle reveals that it is hollow, showing that the Hg is mainly clustered on the surface of microbes. C. Patty et. al. Environ. Sci. Technol. 43, 7397 (2009).

SPECIFIC PROJECTS / ADDITIONAL INFORMATION



- *In situ in-operando* studies of energy storage devices
- X-ray imaging for biofuels to evaluate biomass breakdown
- *In situ* and 3D imaging of functional nano-materials
- *In situ* failure mechanisms in integrated circuits
- Pore-scale investigation of soils and sediments
- *In situ* studies of materials under extreme high pressures
- *In situ* dynamics of freeze-casting for biomaterials
- Micro and nanofluidic devices from biomimetics
- Nanostructure of biological armor
- Micro and nano physiological networks